Net-veined Gyrostemon

(*Gyrostemon reticulatus*)

RECOVERY PLAN

Department of Environment and Conservation
Geraldton

Australian Government

Government of Western Australia

Department of Environment and Conservation
Our environment, our future

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

DEC is committed to ensuring that threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This IRP which results from a review of IRP No. 119. *Gyrostemon reticulatus* (Stack and English 2002) and replaces it. It will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was approved by the Director of Nature Conservation on 30 April 2008. The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate in April 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

IRP PREPARATION

This Interim Recovery Plan was prepared by Alanna Chant[1], Val English[2] and Gillian Stack[3].

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ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this IRP:

Andrew Brown	Threatened Flora Coordinator, Species and Communities Branch, DEC
Andrew Crawford	Senior Technical Officer, Threatened Flora Seed Centre, DEC
Anthony Desmond	Program Leader Nature Conservation, Midwest Region, DEC
Michael Jones	Horticulturalist, Botanic Garden and Parks Authority (BGPA)
Sue Patrick	Former Senior Research Scientist, WA Herbarium, DEC
Kelly Poultney	Technical Officer, Species and Communities Branch, DEC
John Riley	Administrative Officer, Flora, Species and Communities Branch, DEC
Brother van Veen	Amateur Naturalist, Palotine Mission, Tardan

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information. Thanks also to DEC's Species and Communities Branch and the private land holders who provided information on altered contact details, new land divisions and assistance in locating new and old populations in the field.

Cover photograph by Deanne Pember.

CITATION

This Recovery Plan should be cited as:

Department of Environment and Conservation (2009) Net-veined Gyrostemon (*Gyrostemon reticulatus*) Recovery Plan, Department of Environment and Conservation, Perth, Western Australia.

SUMMARY

Scientific Name:	***Gyrostemon reticulatus***	**Common Name:**	Net-veined Gyrostemon
Family:	GYROSTEMONACEAE	**Flowering Period:**	September
DEC Region:	Midwest	**DEC District:**	Geraldton
Shire:	Mullewa	**Recovery Team:**	Geraldton District Threatened Flora Recovery Team
NRM Region:	Northern Agricultural		

Illustrations and/or further information: Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia.* Department of Environment and Conservation, Western Australia; Brown, A., Thomson-Dans, C. and Marchant N. (eds) (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia. pp 75; DEC (1990-) *Threatened Flora Database* (2008) Department of Environment and Conservation (2008) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora.* Department of Environment and Conservation, Western Australia. http://www.calm.wa.gov.au/science/; George, A.S. (1982) Gyrostemonaceae. *Flora of Australia* 8: 393. Australian Biological Resources Study, Canberra.

Analysis of outputs and effectiveness of IRP 119 (2002 – 2007): This IRP replaces IRP No. 119, prepared by Gillian Stack and Val English.

Although the number of known plants in the wild has decreased from 500 to just five, the criteria for success in the previous plan (the number of individuals in populations have increased by 10% or more over the term of the plan) is now not believed to be applicable as *G reticulatus* is a ephemeral species which forms transient components of the above-ground flora, germinating after fire, growing rapidly, flowering, producing seed and dying before the next fire. The second half of the criteria for success (the number of populations have increased by 10% or more over the term of the plan) has been met, as the number of known populations in the wild has increased from two to five (although most of these populations do not currently have extant plants).

Actions carried out through the previous plan include:

Action 3. Conduct further surveys
Action 4. Complete fencing at Population 1
Action 5. Monitor populations
Action 7. Collect seed
Action 10. Promote awareness

Actions 3, 5 and 10 and other recovery actions included in the plan are ongoing and are included in this revised plan.

There are no new actions in this plan.

Current status: *Gyrostemon reticulatus* was declared as Rare Flora in August 2001 under the Western Australian *Wildlife Conservation Act 1950.* Following survey it was found to meet World Conservation Union (IUCN 2001) Red List Category Critically Endangered (CR) under criteria B1ab(iii)+2ab(iii) due to the severe fragmentation of populations, extremely small range and continuing decline in the quality of habitat. *G. reticulatus* is currently listed as Critically Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Gyrostemon reticulatus was thought to be extinct in Western Australia until a specimen collected in 1990 was confirmed to be the species in 2000. Prior to this, the species had not been collected since 1938. In 2001 over 500 plants were recorded in a recently burnt area of vegetation. The population declined rapidly in the following years and in October 2005 only two plants remained at the site. The main threats are limited range, firebreak maintenance, inundation, inappropriate fire regimes and rising salinity.

Five populations are known however four do not contain extant plants and one contains just five plants as at 2008.

Description: *Gyrostemon reticulatus* is an erect shrub to 1 m tall with crowded, persistent linear leaves 11 to 35 mm long. They are circular in cross-section and sometimes have hooked tips. The male and female flowers are on separate plants. The solitary flowers have pointed calyx lobes. Male flowers have twelve to fourteen stamens that end in sharp points and are arranged in a whorl. The female flowers have five to seven carpels with narrow, flattened stigmas about 1 mm long. The stalked, solitary fruit is spherical, and the 3 mm long carpels are semi-circular and narrow towards the margin with patterned surfaces. The species is distinguished from *G. australasicus* by its reticulate carpels with narrow keels and by a generally higher number of stamens (usually nine to twelve in *G. australasicus*) (Brown *et al*. 1998).

Habitat requirements: *Gyrostemon reticulatus* is currently known from a range of approximately 2 km in an area south east of Mullewa, but has historically been recorded from near Canna, Wubin and Kalannie. It grows in dense shrubland with *Melaleuca* species, *Acacia acuminata* and *Allocasuarina campestris* on yellow-brown sandy slopes.

Habitat critical to the survival of the species, and important populations: Given that *Gyrostemon reticulatus* is ranked as CR, it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *G. reticulatus* includes the area of occupancy of populations; areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Gyrostemon reticulatus* will also improve the status of associated native vegetation. To date, no other Rare or Priority Flora have been recorded in association with the species. However, as the habitat is still regenerating after the 2000 fire at Population 1 and soil disturbance at Populations 2 and 3, the identity of many associated species has not yet been recorded. Should other Rare or Priority flora be found in the vicinity of *G. reticulatus*, recovery actions implemented to improve the quality or security of its habitat will also assist in protecting these other Rare and Priority Flora.

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. *Gyrostemon reticulatus* is not listed under any specific international treaty however, and this IRP does not affect Australia's obligations under any other international agreements.

Indigenous consultation: The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of populations of *Gyrostemon reticulatus*, however not all significant sites are listed on the register.

The local organisation representing the indigenous community, the Yamatji Land and Sea Council, was consulted to identify possible indigenous interest in recovery of *Gyrostemon reticulatus*. A representative from this organisation has also been invited to become a member of the Geraldton District Threatened Flora Recovery Team (GDTFRT). This will enable ongoing liaison with the indigenous community and involvement in flora recovery where they have an interest.

Social and economic impacts: The implementation of this recovery plan is unlikely to cause significant adverse social and economic impact. However, as all *Gyrostemon reticulatus* populations occur on private property and unvested reserves, the protection of the species at these sites may potentially affect development and asset protection measures. Population 1 of *G. reticulatus* occurs on private property which is farmed for agriculture. However the remnant vegetation in which the population occurs has been fenced and is excluded from stock. This has been undertaken to protect the rare flora population and to assist in protecting the property against salinity. Populations 2 and 3 of *G. reticulatus* are located on an unvested reserve that is managed as a mission. Recovery actions refer to continued liaison between stakeholders with regard to populations located on private property and unvested reserves.

Affected Interests: The implementation of this plan has some implications for land managers, particularly where populations occur on lands not specifically managed for conservation. The occurrence of a *Gyrostemon reticulatus* population on private property will have implications for the property owners. Where it occurs on an unvested reserve under the care, control and management of the Palotine Mission at Tardan, the mission will be required to ensure protection of the population. Recovery actions refer to continued liaison between stakeholders with regard to all of these areas.

Evaluation of the plan's performance: DEC, in conjunction with the Geraldton District Threatened Flora Recovery Team, will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed within five years of implementation.

Completed recovery actions

1. Land managers have been made aware of the location and threatened status of the species.
2. Declared Rare Flora markers have been installed near the track at Population 1.
3. The remnant vegetation containing Population 1 has been fenced.
4. Some 10644 seeds from Population 1 and 2015 seeds from Subpopulation 2b are stored in DEC's Threatened Flora Seed Centre at –18°C.
5. Surveys located Populations 2 and 3.
6. The area around Kalannie was surveyed for this species in 1990, but was done before its preferred habitat was known.
7. Staff from DEC's Geraldton District undertook surveys in recently burnt areas of similar soil type in a nearby Conservation Park, however no new populations were located.

Ongoing and future recovery actions

1. Staff from DEC's Geraldton District office regularly monitor all known populations.
2. The GDTFRT is overseeing the implementation of this IRP and will include information on progress in its annual report to DEC's Corporate Executive and funding bodies.

IRP Objective: The objective of this IRP is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the species in the wild.

Recovery criteria
Criteria for success: The number of populations have increased and/or the habitat of the species has remained healthy over the five year term of the plan.
Criteria for failure: The number of populations have decreased and/or the habitat of the species has degraded over the five year term of the plan.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Conduct further surveys
4. Seek security of tenure for populations
5. Stimulate the germination of soil-stored seed
6. Obtain biological and ecological information
7. Map habitat critical to the survival of *Gyrostemon reticulatus*
8. Promote awareness
9. Develop and implement a fire management strategy
10. Undertake and monitor translocations, if required
11. Review this plan and assess the need for further recovery actions

1. BACKGROUND

Analysis of outputs and effectiveness of IRP 119 (2002 – 2007): This IRP replaces IRP No. 119, prepared by Gillian Stack and Val English.

Although the number of known plants in the wild has decreased from 500 to just two, the criteria for success in the previous plan (the number of individuals in populations have increased by 10% or more over the term of the plan) is now not believed to be applicable as *Gyrostemon reticulatus* is a ephemeral species that forms transient components of the above-ground flora, germinating after fire, growing rapidly, flowering, producing seed and dying before the next fire.

The second half of the criteria for success in the previous plan (the number of populations have increased by 10% or more over the term of the plan) has been met, as the number of known populations in the wild has increased from two to three.

Actions carried out through the previous plan include:

Action 3. Further surveys have been conducted.
Action 4. The owner of property containing Population 1 has fenced the vegetation remnant containing *Gyrostemon reticulatus* using funding for fencing materials provided by DEC.
Action 5. DEC's Geraldton District Conservation Officer monitors populations regularly.
Action 7. DEC's Threatened Flora Seed Centre (TFSC) holds 10644 seeds from Population 1 and 2015 seeds from Population 2 and has conducted trials to stimulate germination.
Action 10. Articles about the species' rediscovery were printed in local newspapers and helped promote an awareness of the species.

Actions 3, 5 and 10 and other recovery actions included in the plan are ongoing and are included in this revised plan.

No new actions have been included in this Plan.

History

C.A. Gardner first collected *Gyrostemon reticulatus* near Canna in 1933. It was then collected from near Wubin and Kalannie by W. Blackall in 1938 (Blackall and Grieve 1988). It was not seen again for over 50 years and was presumed extinct until recollected in 1990. The 1990 collection was made at Tardan was not confirmed as *G. reticulatus* until March 2000. When the specimen was collected, there were only a few plants present. These were at least ten years old but were still flowering and fruiting. The area was burnt in July 2000 and initially no plants could be found following the fire. However, the species was surveyed again in August 2001 and over 500 plants were counted at that time. Associated species were not regenerating as favourably. Monitoring over several years recorded a rapid decline in the number of *G. reticulatus* plants and in December 2005 only two remained. It is not known why this occurred however, as plants have previously been known to live for over ten years, this unexpected rapid decline may have been due to the young plants experiencing several years of below average rainfall following the fire.

Three *Gyrostemon reticulatus* plants were also found approximately two kilometres away, in an area that had experienced major soil disturbance several years previously. These plants were very close to water tanks and received water through leakage. They were very green, larger and more 'leggy' than those in Population 1 and have since died, possibly due to waterlogging. In 2004 another individual was discovered near a gravel pit several hundred metres from the water tanks. This plant was very small, did not appear healthy in 2004 and was found to be dead during monitoring in 2005.

Five populations are known however four do not contain extant plants and one contains just five plants as at 2008.

Description

Gyrostemon reticulatus is an erect shrub up to 1 m tall with rather crowded, persistent linear leaves 11 to 35 mm long. They are circular in cross-section and sometimes have hooked tips. The male and female flowers are on separate plants. The solitary flowers have pointed calyx lobes. Male flowers have twelve to fourteen stamens, which end in sharp points, and are arranged in a whorl. The female flowers have five to seven carpels with narrow, flattened stigmas about 1 mm long. The stalked, solitary fruit is spherical, and the 3 mm long carpels are semi-circular and narrow towards the margin with patterned surfaces (Brown *et al*. 1998).

The species is distinguished from *Gyrostemon australasicus* by its reticulate carpels with narrow keels, and by the generally higher number of stamens (usually 9 to 12 in *G. australasicus*) (Brown *et al.* 1998).

Distribution and habitat

Gyrostemon reticulatus is currently known from a narrow geographic range south east of Mullewa but has historically been recorded from near Canna, Wubin and Kalannie. It grows on the disturbed edges of dense shrubland with *Melaleuca* species, *Acacia acuminata* and *Allocasuarina campestris* on yellow-brown sandy slopes. As there is evidence that the species behaves as a fire ephemeral, it is likely to be found shortly after a fire event.

Table 1. Summary of population land vesting, purpose and tenure

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. SE of Mullewa	Geraldton	Mullewa	Freehold	Private Property	Landholder
2. SE of Mullewa	Geraldton	Mullewa	Freehold	Unvested Reserve	Church
3. SW of Beacon	Avon-Mortlock	Mt Marshall	Conservation Commission of Western Australia	Nature Reserve	DEC
4. SE of Mullewa	Geraldton	Mullewa	Freehold	Private Property	Landholder
5. SE of Mullewa	Geraldton	Mullewa	WestNet Rail	Railway Reserve	WestNet Rail

All populations are considered to be Important Populations.

Biology and ecology

Gyrostemon reticulatus is dioecious, where male and female flowers occur on separate plants. A large amount of fruit is set per plant, with six or seven seeds per fruit. This ripens progressively, with some fruit mature while the plant still bears fresh flowers. The top flowers brown first during drought conditions.

Several members of the Gyrostemonaceae family are known to be fire ephemerals, or short-lived plants that mainly germinate after fire. Population 1 was known to consist of a few mature plants prior to a fire in 2000. However, following the fire, over 500 plants were found in August 2001. Populations 2 and 3 occur on a site that experienced soil disturbance several years ago. At Population 2, plants that received additional water from nearby rainwater tanks, grew "leggy" and died. While observations suggest germination of this species is triggered by soil disturbance (Population 2) or fire (Population 1), seed did not respond to smoke water or seed coat nicking under laboratory conditions even though it appeared viable. It is likely that some sort of after-ripening treatment is required or there is an unknown dormancy breaking trigger (A. Crawford[1] personal communication).

Seeds of some fire ephemerals are often difficult to germinate *ex situ*, even in response to fire-related cues such as heat and smoke. However, research on dormancy release in Australian fire ephemerals found that four *Gyrostemonaceae* species (*Codonocarpus cotinifolius, Gyrostemon racemiger, G. ramulosus* and *Tersonia cyathiflora*) germinate in the presence of smoke water *ex situ*, and that their germination was enhanced by burial (Baker *et al*. 2005). The requirement for a period of burial before seeds became responsive to smoke and/or heat would ensure that seeds persist in the soil until fire, when there is an increase in nutrients available for growth and reduced competition from other plants (Baker *et al.* 2005).

[1] Andrew Crawford, Senior Technical Officer, DEC's Threatened Flora Seed Centre

Some plants of *Gyrostemon reticulatus* may have the ability to resprout after fire as, thirteen months after the fire at Population 1, plants with a stem diameter of ca. 15 mm had small scars at the base, which may have been fire scars. However, most plants present at that time appeared to have germinated from seed post-fire and were in flower or early fruit. Observations indicate that senescence may occur after plants reach ten years of age but longevity may be affected by seasonal conditions. Population 1 which consisted of over 500 individuals in 2000 declined to only 2 individuals in 2005, a period during which below average rainfall was recorded in three consecutive years. It is possible that the young plants succumbed to drought conditions however there may have been other less obvious factors that influenced population decline.

Gyrostemon reticulatus was believed to only occur on the edges of vegetation, near tracks or firebreaks, not within dense bush. However, plants at Population 1 appeared throughout much of the patch of vegetation that was burnt. This suggests that it is likely to be a fire ephemeral as it produces extremely large quantities of seed very quickly after fire, declines in numbers as the surrounding vegetation becomes denser, and remains primarily as a long-term seed store in the soil. Prior to the 2000 fire a few plants survived near the firebreak and kept producing seed each year. This vegetation is thought to have been burnt approximately ten years prior to the 2000 burn.

The seed has a relatively large aril, which suggests that it is ant dispersed.

Threats

The main threats are limited range, firebreak maintenance, inundation, inappropriate fire regimes and rising salinity.

- **Limited range** is a threat to the species as a single catastrophic event has the potential to cause extinction.

- **Firebreak maintenance** is a potential threat to Population 1 as the remaining plants in the population are located adjacent to a fire break.

- **Inundation** is considered a threat to Population 2. Plants at this population have died and as they have received overflow water from rainwater tanks it is possible that inundation may have been the cause.

- **Inappropriate fire regimes** may affect the viability of populations. The species regenerated well from seed after fire at Population 1, but frequent fire is likely to kill plants before they reach maturity and set sufficient seed. It is also possible that a period of burial after ripening may be required to make the seed more responsive to smoke and heat. Exclusion of occasional fire from areas of remnant vegetation may also be a threat because it is not known how long the seed remains viable in the soil seedbank.

- **Rising salinity** is a potential threat to Population 2 as the area is highly cleared and the population is very close to a creekline.

The intent of this plan is to provide actions that will deal with immediate threats to *Gyrostemon reticulatus*. Unfavourable seasonal conditions when plants are young may have resulted in the rapid decline of the species in Population 1, which consisted of over 500 plants in 2001 and declined to two individuals by 2005. During this period there were several years of below average rainfall. Threats such as low rainfall and climate change may impact on the species over time however actions taken to prevent such threats are beyond the scope of this plan.

Table 2. Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. SE of Mullewa	Private Property	2001 500+ 2003 160 2004 42 2005 2 2008 0	No extant plants but habitat moderate	Firebreak maintenance, inappropriate fire regimes
2a. SE of Mullewa	Unvested Reserve	2001 2 2003 2 2004 0 2005 0 2008 0	No extant plants – no associated native species in immediate vicinity	Inundation, inappropriate fire regimes, salinity
2b. SE of Mullewa	Unvested Reserve	2003 1 2004 0 2005 0 2008 0	No extant plants	
3. SW of Beacon	Nature Reserve	2004 1 2005 0 2008 0	Moderate – associate veg intact although drought stressed & site disturbed	Inappropriate fire regimes
4. SE of Mullewa	Private Property	2008 0	No extant plants	Quarry works
5. SE of Mullewa	Rail Reserve	2008 5	Moderate	Railway works

Note: All populations are considered to be important populations

Guide for decision-makers

The above table provides details of current and possible future threats. Proposed actions in the immediate vicinity of *Gyrostemon reticulatus* populations require assessment for the potential for a significant level of impact.

Habitat critical to the survival of *Gyrostemon reticulatus* and important populations

Given that *Gyrostemon reticulatus* is ranked as CR, it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *G. reticulatus* includes the area of occupancy of populations; areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Gyrostemon reticulatus* will also improve the status of associated native vegetation. To date, no other Rare or Priority Flora have been recorded in association with the species. However, as the habitat is still regenerating after the 2000 fire at Population 1 and soil disturbance at Populations 2 and 3, the identity of many associated species has not yet been recorded. Should other Rare or Priority flora be found in the vicinity of *G. reticulatus*, recovery actions implemented to improve the quality or security of its habitat will also assist in protecting these other Rare and Priority Flora.

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. *Gyrostemon reticulatus* is not listed under any specific international treaty however, and this IRP does not affect Australia's obligations under any other international agreements.

Indigenous consultation

The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of populations of *Gyrostemon reticulatus,* however not all significant sites are listed on the register.

The local organisation representing the Indigenous community, the Yamatji Land and Sea Council, was consulted to identify possible indigenous interest in recovery of *Gyrostemon reticulatus*. A representative from this organisation has also been invited to become a member of the Geraldton District Threatened Flora Recovery Team (GDTFRT). This will enable ongoing liaison with the Indigenous community and involvement in flora recovery where they have an interest.

Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impact. However, as all *Gyrostemon reticulatus* populations occur on private property and unvested reserves, the protection of the species at these sites may potentially affect development and asset protection measures. Population 1 of *G. reticulatus* occurs on private property which is farmed for agriculture. However the remnant vegetation in which the population occurs has been fenced and is excluded from stock. This has been undertaken to protect the rare flora population and to assist in protecting the property against salinity. Populations 2 and 3 of *G. reticulatus* are located on an unvested reserve that is managed as a mission. Recovery actions refer to continued liaison between stakeholders with regard to populations located on private property and unvested reserves.

Affected Interests

The implementation of this plan has some implications for land managers, particularly where populations occur on lands not specifically managed for conservation. The occurrence of a *Gyrostemon reticulatus* population on private property will have implications for the property owners. Where it occurs on an unvested reserve under the care, control and management of the Palotine Mission at Tardan, the mission will be required to ensure protection of the population. Recovery actions refer to continued liaison between stakeholders with regard to all of these areas.

Evaluation of the plan's performance

DEC, in conjunction with the Geraldton District Threatened Flora Recovery Team, will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed within five years of implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

The objective of this IRP is to continue to abate identified threats and maintain or enhance viable *in situ* populations to ensure the long-term preservation of the species in the wild.

Criteria for success: The number of populations have increased and/or the habitat of the species has remained healthy over the five year term of the plan.

Criteria for failure: The number of populations have decreased and/or the habitat of the species has degraded over the five year term of the plan.

Due to *Gyrostemon reticulatus* being a fire ephemeral, populations will persist for periods of time as a soil seedbank without the need of above ground living individuals. Fire ephemerals form transient components of the above-ground flora, germinating after fire, growing rapidly, flowering, producing seed and dying before the next fire. Therefore, it is not deemed necessary to include an increase or decrease in number of individuals within populations in the criteria for success/failure of this IRP.

3. RECOVERY ACTIONS

Completed recovery actions

All relevant land managers have been notified of the location and threatened status of *Gyrostemon reticulatus*. The notification details the Declared Rare status of the species and the associated legal responsibilities.

Declared Rare Flora markers have been installed on the track near Population 1. Their purpose is to alert people working in the vicinity to the presence of DRF and the need to avoid work that may cause damage to plants or habitat.

The remnant vegetation containing Population 1 was partially fenced by the land manager in 1996 and was finished in 2002 with materials provided by DEC. The site was grazed prior to then, but is still well vegetated.

Some 10644 seeds collected from Population 1, and 2015 seeds collected from Population 2b are stored in DEC's Threatened Flora Seed Centre (TFSC) at -18°C. Staff of the TFSC test the viability of seed soon after collection and again after one year in storage. Trials using smoke and scarification were unsuccessful in assisting germination. Research into the nature of dormancy in the Gyrostemonaceae found that a period of soil burial can render seeds more responsive to germination cues.

Following the original 1990 collection at the Tardan Pallotine mission, further searches on the property resulted in Populations 2a, 2b and 3 being located.

The Kalannie area was surveyed unsuccessfully for *Gyrostemon reticulatus* in 1990. However, this was undertaken before accurate habitat information was available.

Staff from DEC's Geraldton District undertook surveys in recently burnt areas of similar soil type in a nearby Conservation Park, however no new populations were located.

Ongoing and future recovery actions

Staff from DEC's Geraldton District office regularly monitor all known populations.

The GDTFRT will oversee the implementation of this IRP and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The GDTFRT will coordinate recovery actions for *Gyrostemon reticulatus* and other DRF in the Geraldton District. They will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (Geraldton District) through the GDTFRT
Cost: $500 per year

2. Monitor populations

Annual monitoring of factors such as habitat degradation, wind damage, population stability (expansion or decline), weed invasion, pollination activity, seed production, recruitment, longevity, predation and variation in seasonal conditions is essential. Special attention will be paid to any indicators of rising salinity.

Action: Monitor populations
Responsibility: DEC (Geraldton District) through the GDTFRT
Cost: $2,000 per year

3. Conduct further surveys

Community volunteers will be encouraged to become involved in further surveys for *Gyrostemon reticulatus* conducted by DEC staff during the species' flowering period (September-October). Areas recently burnt or disturbed near known populations and previous collection sites require further survey. In particular a previous collection recorded in the Merredin District will need to be relocated and a thorough survey undertaken. Other areas may include Kalannie, Wubin, Mullewa and Canna.

Action: Conduct further surveys
Responsibility: DEC (Geraldton and Merredin Districts) through the GDTFRT and MDTFRT
Cost: $4,000 per year

4. Seek security of tenure for populations

The conservation status of land that supports all populations will be reviewed and the possibility of purchase and/or a change of land tenure investigated. Protecting important populations on private land through conservation covenants or registration with the Land for Wildlife or other private land conservation schemes will also be investigated. This action will secure habitat on which *Gyrostemon reticulatus* can be managed and promote conditions that will result in an increase in the size and health of populations.

Action: Seek security of tenure for populations
Responsibility: DEC (Geraldton District) through the GDTFRT
Cost: $1,000 per year

5. Stimulate the germination of seed stored in the soil

It is believed that burning, smokewater and/or soil disturbance, or other treatments at appropriate intervals may be necessary to retain viable populations of *Gyrostemon reticulatus* by stimulating the germination of seed stored in the soil particularly given the difficulty in germinating seed *ex situ*. Trials to stimulate germination of soil-stored seed should be undertaken prior to considering translocation for this species.

These trials will be conducted in the area adjacent to Populations 1 and 2, in consultation with the relevant land managers.

Action: Stimulate the germination of soil-stored seed
Responsibility: DEC (Geraldton District) through the GDTFRT
Cost: $4,400 in first and fourth years and $1,000 in other years

6. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Gyrostemon reticulatus* will provide a better scientific basis for management of the wild populations. An understanding of the following is particularly necessary for effective management:

1. Investigate the species' response to disturbance, including fire, following Adaptive Management principles.
2. Investigate the species' pollination biology.
3. Investigate the levels of flower and fruit production.
4. Investigate seed longevity and viability.
5. Investigate conditions necessary for germination.
6. Determine longevity of plants and time taken to reach maturity.
7. Investigate genetic diversity.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Geraldton District) through the GDTFRT
Cost: $20,900 per year for the first three years

7. Map habitat critical to the survival of *Gyrostemon reticulatus*

Although critical habitat to the survival of the species is described in Section 1, the areas described have not yet been accurately mapped and will be addressed under this action. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action: Map habitat critical to the survival of *Gyrostemon reticulatus*
Responsibility: DEC (Geraldton District) through the GDTFRT
Cost: $3,000 in the second year

8. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this species will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged. An information sheet, which includes a description of the plant, its habitat, threats, recovery actions and photos will be produced.

A reply paid postal drop illustrating *Gyrostemon reticulatus* and describing its distinctive features and habitat will be produced and distributed by DEC's Geraldton and Merredin District offices to local farmers and other residents in Shires containing possible habitat of the species. Postal drops aim to stimulate interest, provide information about threatened species and provide a name and number to contact if new populations are found by members of the community.

Action: Promote awareness
Responsibility: DEC (Geraldton and Merredin Districts; Species and Communities Branch (SCB) and Strategic Development and Corporate Affairs Division) through the GDTFRT and MDTFRT
Cost: $1,900 in first year, $1,200 in second year and $900 in subsequent years

9. Develop and implement a fire management strategy

A fire management strategy will be developed to determine fire control measures and fire frequency. Observations indicate that a burn frequency of ten years or slightly longer may be suitable to maintain the species, however, in the case of Population 1 which has declined rapidly in five years, a small scale regeneration burn may be useful following appropriate trials.

Action: Develop and implement a fire management strategy
Responsibility: DEC (Geraldton District) through the GDTFRT and relevant authorities
Cost: $2,600 in first year and $1,000 in subsequent years

10. Undertake and monitor translocations, if required

If attempts to stimulate regeneration are not successful, translocations may need to be considered for the conservation of this species. This approach will require the development of a translocation proposal and selection of suitable translocation sites. Normal protocols involve the propagation of material prior to planting out in accordance with an approved Translocation Proposal. Given the difficulties associated with *ex situ* seed germination for the species and the experimental nature of vegetative micropropagation techniques to date, alternative methods, other than *ex-situ* propagation, may need to be investigated.

Information on the translocation of threatened plants and animals in the wild is provided in the Department's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. Any translocation proposals will be consistent with the *Guidelines for the translocation of threatened plants in Australia*, produced by the ANPC (

Vallee et al. 2004). All translocation proposals require endorsement by the Department's Director of Nature Conservation. Monitoring of the translocation is essential and will be undertaken according to the timetable developed for the Translocation Proposal.

Action: Undertake and monitor translocation, if required
Responsibility: DEC (Science Division, Geraldton District) through the GDTFRT
Cost: $36,000 in the fourth year and $2,000 in the fifth year

11. Review this plan and assess the need for further recovery actions

If *Gyrostemon reticulatus* is still ranked Critically Endangered at the end of the five-year term of this IRP, the need for further recovery actions, or a review of this IRP will be assessed and a revised plan prepared if necessary.

Action: Review this plan and assess the need for further recovery actions
Responsibility: DEC (SCB, Geraldton District) through the GDTFRT
Cost: $1,500 in year 5

Table 3: Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	GDTFRT	Ongoing
Monitor populations	High	DEC (Geraldton District) through the GDTFRT	Ongoing
Conduct further surveys	High	DEC (Geraldton and Merredin Districts) through the GDTFRT and MDTFRT	Ongoing
Seek security of tenure for populations	High	DEC (Geraldton District) through the GDTFRT	Ongoing
Stimulate the germination of soil-stored seed	High	DEC (Geraldton District) through the GDTFRT	Ongoing
Obtain biological and ecological information	Moderate	DEC (Science Division, Geraldton District) through the GDTFRT	2011
Map habitat critical to the survival of *Gyrostemon reticulatus*	Moderate	DEC (Geraldton District) through the GDTFRT	2010
Promote awareness	Moderate	DEC (Geraldton and Merredin Districts, Species and Communities Branch (SCB) and Strategic Development and Corporate Affairs Division) through the GDTFRT and MDTFRT	Ongoing
Develop and implement a fire management strategy	Moderate	DEC (Geraldton District) through the GDTFRT and relevant authorities	Developed by 2009 with implementation ongoing
Undertake and monitor translocations, if required	Moderate	DEC (Science Division, Geraldton District) through the GDTFRT	2013
Review this plan and assess the need for further recovery actions	Moderate	DEC (SCB, Geraldton District) through the GDTFRT	2013

4. TERM OF PLAN

Western Australia

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. If *Gyrostemon reticulatus* is still ranked CR after five years, this IRP will be reviewed and, if necessary, further recovery actions put in place.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than five years.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

George, A.S. (1982) Gyrostemonaceae. *Flora of Australia* 8: 393. Australian Biological Resources Study, Canberra.

Gyrostemon reticulatus A shrub c. 1 m tall. Branchlets slender, striate when dried. Leaves linear-terete, rather crowded, 11-35 mm long, 1-1.5 mm wide, acute, sometimes uncinate; stipules swollen, oblique, c. 0.3 mm long, brown or golden. Flowers solitary, axillary. Male flowers: pedicels c. 1 mm long, spreading; calyx 1 mm long, shallowly lobed, the lobes broad, obtuse; stamens 12-14 in 1 whorl, shortly and obtusely apiculate; disc convex. Female flowers: pedicels c. 1 mm long, spreading to recurved; calyx 0.5 mm long, divided to ½ into triangular, acute lobes; carpels 5-7; stigmas narrow, flattened, united at base, 1 mm long, soon curling. Fruit spherical; carpels semi-circular, narrowed towards margin; 3 mm long, the faces reticulate. Seed obovate, c. 1 mm long, rugose, red-brown, attached at base; aril small.

Distinguished from *G. australasicus* by the reticulate carpels with narrow keels.

SUMMARY OF RECOVERY ACTIONS AND COSTS

	Year 1			Year 2			Year 3			Year 4			Year 5		
Recovery Action	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**
Coordinate recovery actions	300	100	100	300	100	100	300	100	100	300	100	100	300	100	100
Monitor populations	1000		1000	1000		1000	1000		1000	1000		1000	1000		1000
Conduct further surveys	1500	500	2000	1500	500	2000	1500	500	2000	1500	500	2000	1500	500	2000
Seek security of tenure for populations	500		500	500		500	500		500	500		500	500		500
Stimulate the germination of soil-stored seed	2500		1900	200		800	200		800	2500		1900	200		800
Obtain biological and ecological information	8900		12000	8900		12000	8900		12000						
Map habitat critical to the survival of *Gyrostemon reticulatus*				900		2100									
Promote awareness	1200		700	1200			900			900			900		
Develop and implement a fire management strategy	1400	1200		200	800		200	800		200	800		200	800	
Undertake and monitor translocation, if required										6000		30000	1000		1000
Review this plan and assess the need for further recovery actions													1500		
Total	17300	1800	18200	14700	1400	18500	13500	1400	16400	12900	1400	35500	7100	1400	5400
Yearly Total	**37,300**			**34,600**			**31,300**			**49,800**			**13,900**		

Ext. = External Funds (funding to be sought), Other = funds contributed by volunteer input and BGPA in-kind contribution.

Total DEC: $65,500
Total Other: $7,400
Total External Funding: $94,000
Total Costs: $166,900